Process control of polyamide-6,6

Application

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Polyamide-6,6 is a synthetic polyamide typically produced by polymerizing hexamethylendiamine and adipinic acid. It is widely used for the production of fibres, foils and raw materials. Typical applications are in the clothing industry for stockings and sports apparel, in the building industry for synthetic carpets and in the electronic industry for housings. The properties of polyamide-6,6 strongly depend on molecular weight and molecular weight distribution.

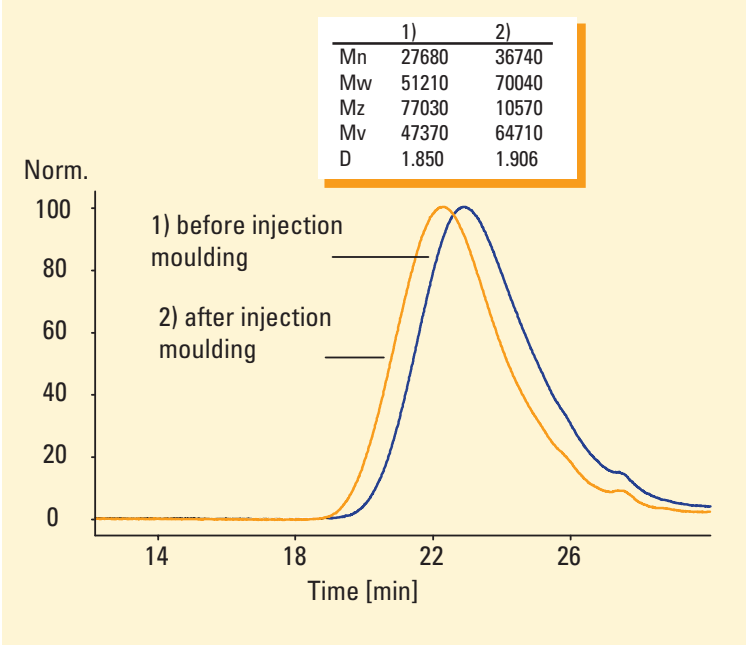

Figure 1
Overlay of two chromatograms of a technical polyamide-6,6 used for producing the housing of drilling machines

Conditions

Sample preparation
Samples were dissolved in the mobile phase and filtered (0.45 µm).
Polystyrene EasyCal vial standards (Agilent p/n 5064-8281) were used for narrow standard calibration.

Column
PFGgel 10^3 A, 8 x 300 mm, 5 µm in series with a PFGgel 300 Å, 8 x 300 mm, 5 µm and a PFGgel 100 A, 8 x 300 mm, 5 µm

Mobile phase
Trifluoroethanol and 1 g/l potassiumtrifluoroacetate

Flow rate
1.0 mL/min

Column compartment temperature
35 ° C

Injection volume
10 µL

Detector
Variable wavelength detector, 254 nm

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Figure 1 shows an overlay of two chromatograms of a technical polyamide-6,6 used for the production of the housing of drilling machines. One chromatogram was obtained with the original granulate and the other one after injection moulding. The picture and table clearly show that the moulding process changes the chromatograms and the molecular weight data. For a consistent product quality the moulding process needs to be optimized and controlled by GPC-SEC. Because of the insolubility of polyamide-6,6 in typical GPC-SEC eluents such as tetrahydofuran, toluene or dimethylformamide trifluoroethanol was used. To reduce the number of adsorptive sites on the stationary phase 1g/l of potassiumtrifluoroacetate was added to the mobile phase.

HPLC performance

RSD of M_w	< 1%
RSD of M_n	< 2%

Equipment

Agilent 1100 Series GPC-SEC system
consisting of
- vacuum degasser for efficient degassing of the mobile phase
- isocratic pump with large solvent cabinet
- autosampler with single valve design
- thermostatted column compartment for precise column temperatures
- refractive index detector with automatic recycle valve
- ChemStation Plus with GPC-SEC data analysis software

Columns supplier:
Polymer Standards Service, Mainz, Germany

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